What is claimed is:

1. An apparatus for determining magnetic susceptibility in an object, the temperatures being maintained at approximately 77K, the apparatus comprising:

a permanent magnet;

a superconducting quantum interference device constructed from material having a critical temperature above 77K;

a flexible superconducting flux transformer that couples the susceptibility signal to the superconducting quantum interference device, the transformer comprising superconducting material disposed on a flexible metallic substrate.

2. The apparatus as set forth in claim 1 wherein the permanent magnet is formed of neodymium (Nd), boron (B) and iron (Fe).

3. The apparatus as set forth in claim 1 wherein the flexible superconducting flux transformer comprises a nickel based substrate having disposed thereon a layer of yttria-stabilized zirconia and a thick film of epitaxial yttrium barium copper oxide.

4. The apparatus as set forth in claim 1 wherein the object is the (in-vivo) human liver.

5. The apparatus as set forth in claim 1 wherein the object is (in-vivo) human bone.

6. An apparatus for the measurement of the magnetic susceptibility of an object, the apparatus comprising:

at least one magnetic field source operable to produce a stable magnetic field at

liquid nitrogen temperatures;

at least one superconducting flux transformer formed from $Y_1Ba_2Cu_3O_7$ and having a first loop or coil encircling and a first area immersed in the magnetic field, a second loop or coil encircling a second area and a connection between the first loop or coil and the second loop or coil;

at least one high T_c superconducting quantum interference device, in close proximity, at least in part, to the second loop or coil of the superconducting flux transformer, the superconducting quantum interference device measuring the effect of the addition of flux from other magnetic fields introduced through the first loop or coil.

7. The apparatus of claim 6 wherein the magnetic field source is a permanent magnet.

8. The apparatus of claim 7 wherein the permanent magnet is made of neodymium boron ferrite.

9. The apparatus of claim 6 wherein the at least one superconducting quantum interference device is inductively coupled to the flux transformer and measures current that is induced in the flux transformer.

10. The apparatus of claim 6 wherein the at least one superconducting flux transformer is flexible.

11. The apparatus of claim 6 further comprising:

a data processing system;

at least one superconducting quantum interference device controller;

at least one cable connecting the at least one superconducting quantum interference device to the at least one superconducting quantum interference device controller;

at least one cable connecting the at least one superconducting quantum interference device controller to the data processing system;

data acquisition software run on the data processing system;

system control software run on the data processing system;

data analysis software run on the data processing system.

a housing enclosing the at least one magnetic field source, the at least one superconducting flux transformer, and the at least one superconducting quantum interference device;

a gantry supporting the housing;

a support surface for supporting the object in proximity to the housing; and,

an interface device between the housing and the object.

12. The apparatus of claim 11 wherein the gantry movably supports the housing relative to the support surface.

13. The apparatus of claim 11 wherein the support surface movably supports the object relative to the housing.

14. The apparatus of claim 11 wherein the housing further houses a refrigerant.

15. The apparatus of claim 14 wherein the refrigerant is liquid nitrogen.

16. A method for determining magnetic susceptibility in an object, the method

comprising steps of:

applying a magnetic field to a zone using a permanent magnet;

moving the object into the zone;

inducing a current in a flexible superconducting flux transformer based on a change in the magnetic field when the object is moved into the zone;

detecting the induced current in the transformer by a superconducting quantum interference device that has a high critical temperature; and

calculating the magnetic susceptibility of the object based on the detected induced current.